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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2021-0228; Special Conditions No. 25-787-SC]

Special Conditions: Haeco Cabin Solutions, Boeing Commercial Airplanes Model 737-800 Airplane; Structure-Mounted Airbags

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the Boeing Commercial Airplanes (Boeing) Model 737-800 airplane. This airplane, as modified by Haeco Cabin Solutions (Haeco), will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport category airplanes. This design feature is structure-mounted airbags designed to protect each occupant from serious head injury in the event of an emergency landing. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: Effective [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER].

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SUPPLEMENTARY INFORMATION:

Background

On September 1, 2020, Haeco applied for a supplemental type certificate for structure-mounted airbags in the Boeing Model 737-800 airplane. The Boeing Model 737-800 airplane, which is a derivative of the Boeing Model 737 airplane currently approved under Type Certificate No. A16WE, is a twin-engine, transport-category airplane with seating for 189 passengers and a maximum takeoff weight of 174,200 pounds.

Type Certification Basis

Under the provisions of title 14, Code of Federal Regulations (14 CFR) 21.101, Haeco must show that the Boeing Model 737-800 airplane, as changed, continues to meet the applicable provisions of the regulations listed in Type Certificate No. A16WE or the applicable regulations in effect on the date of application for the change, except for earlier amendments as agreed upon by the FAA.

If the Administrator finds that the applicable airworthiness regulations (e.g., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Boeing Model 737-800 airplane because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the applicant apply for a supplemental type certificate to modify any other model

included on the same type certificate to incorporate the same novel or unusual design feature, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the Boeing Model 737-800 airplane must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34, and the noise certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under § 21.101.

Novel or Unusual Design Features

The Boeing Model 737-800 airplane will incorporate the following novel or unusual design features:

Airbags mounted to structure to prevent head injury.

Discussion

Haeco will install structure-mounted airbags instead of inflatable lap belts as a means to protect each occupant from serious injury in the event of an emergency landing, as required by § 25.562(c)(5), on 737-800 airplanes.

Such use of airbags to provide injury protection for the occupant is a novel or unusual feature for this airplane model, and the applicable airworthiness regulations do not contain adequate or appropriate airworthiness standards for these design features. Therefore, special conditions are needed to address requirements particular to installation of airbags in this manner.

Special conditions exist for airbags installed on seat belts, known as inflatable lap belts, which have been installed on transport airplane passenger seats. Structure-mounted

airbags, although a novel design, were first introduced on Jetstream Aircraft Limited Model 4100 series airplanes, which resulted in issuance of Special Conditions 25-ANM-127 on May 14, 1997. These special conditions supplemented 14 CFR part 25 and, more specifically, §§ 25.562 and 25.785.

The structure-mounted airbag, similar to the inflatable lap belt, is designed to limit occupant forward excursion in the event of an emergency landing. These airbags will reduce the potential for serious injury, including reducing the head-injury criterion measurement defined in part 25. However, structure-mounted airbags function similarly as automotive airbags, where the airbag deploys from furniture located in front of the passenger, relative to the airplane's direction of flight, forming a barrier between the structure and occupant. Also, unlike the inflatable lap belt, the structure-mounted airbag does not move with the occupant. To account for out-of-position and brace-position occupants, the airbag is designed to conform to the curvature of the exposed structure in the head-strike zone.

Because the airbag system is essentially a single-use device, it could deploy under crash conditions that are not sufficiently so severe as to require the injury protection the airbag system provides. Because an actual crash is frequently composed of a series of impacts before the airplane comes to rest, a larger impact following the initial impact could render the airbag system unavailable. This potential situation does not exist with standard upper-torso restraints, which tend to provide continuous protection regardless of impact severity, or number of impacts, in a crash event. Therefore, the airbag system installation should be such that it provides protection, when it is required, by not expending its protection when it is not required. If the airbag deployment threshold is

unnecessarily low, the airbag would need to continue to provide protection when an impact requiring protection occurs.

These special conditions are based upon Special Conditions 25-605-SC for the Boeing Model 787-9 airplanes equipped with B/E Aerospace Super-Diamond model business-class passenger seats and associated furniture. Additionally, the special conditions address protection of the occupant's neck and spine for the structure-mounted airbag deployment. When using the HIC15 head-injury method for airbag impacts (calculated in accordance with 49 CFR 571.208) the neck and spine limits are included as part of the allowance.

These additional conditions are based on special conditions issued previously on oblique seats. The proposed special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

Discussion of Comments

The FAA issued Notice of Proposed Special Conditions No. 25-21-01-SC for the Boeing Model 737-800 series airplane, which was published in the *Federal Register* on March 16, 2021 (86 FR 14387). No comments were received, and the special conditions are adopted as proposed.

Applicability

As discussed above, these special conditions are applicable to the Boeing Model 737-800 airplane as modified by Haeco. Should Haeco apply at a later date for a supplemental type certificate to modify any other model included on Type Certificate No.

A16WE to incorporate the same novel or unusual design feature, these special conditions would apply to that model as well.

Under standard practice, the effective date of final special conditions would be 30 days after the date of publication in the *Federal Register*. However, as the certification date is imminent, the FAA finds that good cause exists to make these special conditions effective upon publication.

Conclusion

This action affects only a certain novel or unusual design features on one model of airplane. It is not a rule of general applicability and affects only the applicant who applied to the FAA for approval of these features on the airplane.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

Authority Citation

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for Boeing Model 737-800 airplanes, as modified by Haeco Cabin Solutions:

1. The applicant must demonstrate by test that the structure-mounted airbag will deploy and provide protection under crash conditions where it is necessary to prevent serious injury to a 50th percentile occupant, as specified in § 25.562. The means of protection must provide a consistent approach to energy absorption for a

range of occupants, from a two-year-old child to a 95th percentile male. In addition, the following situations should be considered:

1. The seat occupant is holding an infant.
2. The seat occupant is a child in a child restraint device.
3. The seat occupant is a child not using a child restraint device.
4. The seat occupant is a pregnant woman.

a. Head-Injury Criteria

Compliance with § 25.562(c)(5) is required, except that, if the ATD has no apparent contact with the seat/structure but has contact with an airbag, a head-injury criterion (HIC) unlimited score in excess of 1000 is acceptable, provided the HIC15 score (calculated in accordance with 49 CFR 571.208) for that contact is less than 700.

b. Body-to-Wall/Furnishing Contact

If a seat is installed aft of structure (e.g., an interior wall or furnishing) that does not provide a homogenous contact surface for the expected range of occupants and yaw angles, then additional analysis or tests may be required to demonstrate that the injury criteria are met for the area that an occupant could contact. For example, if different yaw angles could result in different airbag performance, then additional analysis or separate tests may be necessary to evaluate performance.

c. Neck-Injury Criteria

The seating system must protect the occupant from experiencing serious neck injury. The assessment of neck injury must be conducted with the airbag device activated,

unless there is reason to also consider that the neck-injury potential would be higher for impacts below the airbag-device deployment threshold.

(1) The N_{ij} (calculated in accordance with 49 CFR 571.208) must be below

1.0, where $N_{ij} = F_z/F_{zc} + M_y/M_{yc}$, and N_{ij} critical values are:

(a) $F_{zc} = 1,530$ lb for tension

(b) $F_{zc} = 1,385$ lb for compression

(c) $M_{yc} = 229$ lb-ft in flexion

(d) $M_{yc} = 100$ lb-ft in extension

(2) In addition, peak F_z must be below 937 lb in tension and 899 lb in compression.

(3) Rotation of the head about its vertical axis, relative to the torso, is limited to 105 degrees in either direction from forward-facing.

(4) The neck must not impact any surface that would produce concentrated loading on the neck.

d. ATD and Test Conditions

Longitudinal tests conducted to measure the injury criteria above must be performed with the FAA Hybrid III ATD, as described in SAE 1999-01-1609, “A Lumbar Spine Modification to the Hybrid III ATD for Aircraft Seat Tests.” The tests must be conducted with an undeformed floor, at the most-critical yaw cases for injury, and with all lateral structural supports (e.g. armrests or walls) installed.

Note: Applicant must demonstrate that the installation of seats via plinths or pallets meets all applicable requirements. Compliance with the guidance contained in policy memorandum PS-ANM-100-2000-00123, “Guidance for

Demonstrating Compliance with Seat Dynamic Testing for Plinths and Pallets,” dated February 2, 2000, is acceptable to the FAA.

2. The structure-mounted airbag must provide adequate protection for each occupant regardless of the number of occupants of the seat assembly.
3. The structure-mounted airbag system must not be susceptible to inadvertent deployment as a result of wear and tear, or inertial loads resulting from in-flight or ground maneuvers (including gusts and hard landings) likely to be experienced in service.
4. The applicant must demonstrate that an inadvertent deployment that could cause injury to a standing or sitting person is improbable. Inadvertent deployment must not cause injury to anyone who may be positioned close to the structure-mounted airbag (e.g., seated in an adjacent seat, or standing adjacent to the airbag installation or the subject seat). Cases where a structure-mounted airbag is inadvertently deployed near a seated occupant or an empty seat must be considered.
5. Inadvertent deployment of the structure-mounted airbag during the most critical part of flight will either not cause a hazard to the airplane or is extremely improbable.
6. Deployment of the structure-mounted airbag must not introduce hazards or injury mechanisms to the seated occupant, including occupants in the brace position. Deployment of the structure-mounted airbag must also not result in injuries that could impede rapid exit from the airplane.

7. Effects of the deflection and deformation of the structure to which the airbag is attached must be taken into account when evaluating deployment and location of the inflated airbag. The effect of loads imposed by airbag deployment, or stowed components where applicable, must also be taken into account.
8. The applicant must demonstrate that the structure-mounted airbag, when deployed, does not impair access to the seatbelt- or harness-release means, and must not hinder evacuation. This will include consideration of adjacent seat places and the aisle.
9. The airbag, once deployed, must not adversely affect the emergency-lighting system, and must not block escape-path lighting to the extent that the light(s) no longer meet their intended function.
10. The structure-mounted airbag must not impede occupants' rapid exit from the airplane 10 seconds after its deployment.
11. Where structure-mounted airbag systems are installed in or close to passenger evacuation routes (other than for the passenger seat for which the airbag is installed), possibility of impact on emergency evacuation (e.g., hanging in the aisle, potential trip hazard, etc.) must be evaluated.
12. The airbag electronic system must be designed to be protected from lightning per § 25.1316(b), and high-intensity radiated fields per § 25.1317(c).
13. The structure-mounted airbag system must not contain or release hazardous quantities of gas or particulate matter into the cabin.
14. The structure-mounted airbag installation must be protected from the effects of fire such that no hazard to occupants will result.

15. The inflatable bag material must meet the 2.5-inches-per-minute horizontal flammability test defined in 14 CFR part 25, appendix F, part I, paragraph (a)(1)(iv).
16. The design of the structure-mounted airbag system must protect the mechanisms and controls from external contamination associated with that which could occur on or around passenger seating.
17. The structure-mounted airbag system must have a means to verify the integrity of the structure-mounted airbag activation system.
18. The applicant must provide installation limitations to ensure installation compatibility between the seat design and opposing monument or structure.

Issued in Kansas City, MO, on May 21, 2021.

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